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Sexual reassignment surgery in female-to-male transsexuals: An algorithm for subcutaneous mastectomy[☆]

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KEYWORDS

Female-to-male transsexuals;
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Chest-wall contouring

Summary *Introduction:* Subcutaneous mastectomy is one of the first steps in sexual reassignment in female-to-male transsexuals (FTMTS). The main goal is to masculinize the chest by removing the female contour. In this study, we introduce an algorithm to facilitate choosing the appropriate mastectomy technique depending on morphological aspects.

Patients and methods: The records of 173 patients (346 mastectomies) from January 2008 to December 2013 were retrospectively reviewed. The authors conducted four different surgical techniques depending on breast volume, grade of ptosis and skin elasticity. The outcome parameters such as complication rate, patient satisfaction with the aesthetic result, nipple sensitivity and surgical correction rate were obtained and related to the employed technique.

Results: From January 2008 to December 2013, we performed 346 mastectomies, of which 48 breasts (13.9%) were treated by a semicircular incision in combination with water-jet-assisted liposuction, 66 breasts (19.1%) by an additional circumferential mastopexy, 170 breasts (49.1%) by an inferior pedicled mammoplasty and 62 breasts (17.9%) by mastectomy with free nipple grafting. The mean operation time lasted 103.6 min. The overall complication rate was 11.8%. Secondary revisions were necessary in 9%. Of the patients, 88% rated the aesthetic results as “very good” or “good.” Nipple sensitivity was rated as “very good” or “good” in 80.3% of the breasts.

Conclusion: FTMTS are a well-informed patient population and therefore increasingly more demanding for aesthetic outcomes. If possible, the most scar-saving procedure should be

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preferred. With ascending degrees of ptosis, a larger skin envelope and lesser elastic skin, an extended-incision technique is required. The presented surgical algorithm facilitates the selection of the appropriate mastectomy technique and shows a high patient satisfaction with the aesthetic result, a preservation of nipple sensitivity and a low rate of complications and secondary aesthetic corrections.

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Introduction

Mastectomy usually is the first step in sexual reassignment surgery in female-to-male transsexuals (FTMTS). Creating a new male-like personality physically as well as emotionally helps the patients to improve their psychosocial state of mind. To date, various operative procedures have been reported including a semicircular, transareolar, concentric circumareolar and extended concentric circular approach, wise pattern reduction, inferior pedicled and free nipple–areola complex (NAC) graft.^{1,2} The goal of the subcutaneous mastectomy (SCM) is to masculinize the chest by removing the female contour. To choose the appropriate surgical technique, not only the breast volume but also the degree of skin excess and skin elasticity, the relation of the position of the NAC to the inframammary fold (IMF) as well as the grade of breast ptosis have to be considered.

Hage and Bloem³ and Hage and Kesteren² defined the following goals for SCM in FTMTS: (1) aesthetic contouring

of the chest wall by removal of breast tissue and skin excess, (2) proper reduction and positioning of the nipple and areola, (3) obliteration of the IMF and (4) minimization of chest-wall scars.

Monstrey et al.⁴ concluded in 2008 that skin excess and skin elasticity are the key factors in choosing the appropriate mastectomy technique and reflected this in their algorithm.

In this article, we present a large series of FTMTS who have undergone SCM. Four surgical techniques are reviewed and critically evaluated by four outcome parameters. Based on these results, we developed an algorithm (Table 1) to facilitate the selection of the appropriate technique for SCM in female-to-male-transsexuals.

Patients and methods

The records of 173 FTMTS who underwent 346 mastectomies under general anesthesia from January 2008 to December 2013 were retrospectively reviewed. The oper-

Table 1 Algorithm for four subcutaneous mastectomy techniques in female-to-male transsexuals (FTMTS). (NAC: nipple–areola complex, IMF: inframammary fold, WAL: water-jet-assisted liposuction, SSCM: semicircular subcutaneous mastectomy).

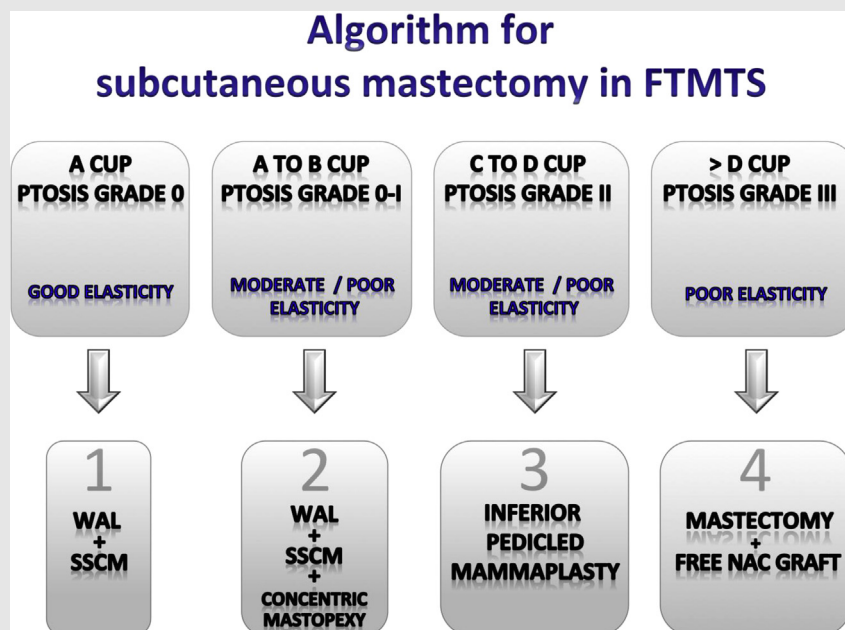


Table 2 Overall collective.

	Overall collective <i>n</i> = 346	Group 1 WAL + SSCM (<i>n</i> = 48, 13.9%)	Group 2 WAL + SSCM + concentric mastopexy (<i>n</i> = 66, 19.1%)	Group 3 Inferior pedicled mammaplasty (<i>n</i> = 170, 49.1%)	Group 4 Mastectomy and free NAC graft (<i>n</i> = 62, 17.9%)
Age (years)	28.6 (16–54)	24.8 (19–51)	24.3 (18–42)	29.9 (18–54)	32.5 (16–54)
Body mass index (kg/m ²)	24 (17.1–39)	19.2 (17.1–24.5)	20.8 (18.5–32.7)	24.6 (18–39)	29.1 (22–39)
Sternal notch–NAC distance (cm)	20.8 (15–36)	17.4 (16–20)	19.9 (18–23)	23.8 (18–35)	28 (23–36)
Operation time (min)	103.6 (37–198)	105.2 (37–179)	106.5 (60–160)	110.8 (59–198)	79.4 (56–120)
Hospital stay (days)	4.9 (2–9)	4.4 (3–8)	4.6 (3–9)	4.8 (2–9)	5.4 (3–9)
Resected tissue right (g)	354.1 (35–1700)	127.2 (35–500)	129.7 (63–230)	425.3 (88–1250)	742.4 (244–1700)
Resected tissue left (g)	352.1 (31–1400)	116.3 (31–450)	130.8 (57–240)	428.7 (93–1018)	730 (208–1400)

Demographics and basic data (WAL: water-jet-assisted liposuction, SSCM: semicircular subcutaneous mastectomy, NAC: nipple–areola complex).

ative procedure was selected according to breast size, grade of mastoptosis, amount of skin envelope, skin elasticity and NAC diameter. The authors classified four different surgical techniques (Table 1). The data collected also included patient demographics (age, body mass index (BMI), distance between sternal notch and NAC, operation time, hospital stay and amount of resected breast tissue) (Table 2). Outcome parameters such as complication rate, patient satisfaction with the aesthetic result, nipple sensitivity and the need to reoperate were observed and related to the employed technique (Tables 3 and 4). All patients were photographed preoperatively, 3 months and 1 year postoperatively in standard perspectives.

In cases with very small breasts (A Cup), mastoptosis grade 0 by Regnault⁵ and good skin elasticity (Group 1), we performed liposuction followed by SCM through a semi-circular incision (SSCM) (Figure 1). For contouring liposuction and hydrodissection between the gland and the subcutaneous layer or the pectoral fascia, we used water-jet-assisted lipoplasty (WAL) with the BODY-JET[®] system

by Human Med[®] (1860 Crown Drive, Suite 1408, Dallas, TX, USA). For tumescence, 1000 ml Ringer's solution with 1 ml of 1:1000 diluted adrenaline was used. The liposuction cannula diameter was 3.5–3.8 mm. The mammary gland was released by sharp subcutaneous dissection of the suspensory Cooper's ligaments and epifascially on the pectoralis muscle. To avoid areolar depression, a sufficient amount of glandular tissue should be left in situ under the NAC. Drains were placed in all cases via stab incisions for liposuction.

In cases with small breasts (A–B Cup), mastoptosis grade 0–I and moderate to poor skin elasticity (Group 2), we adopted the concentric circumareolar approach (Figure 2).

The concentric incisions were marked as an outer and internal circle enabling deepithelialization between these circles. Access to the gland was gained through an inferior incision close to the outer circle leaving a wide pedicle for good blood supply of the NAC. A purse-string suture was placed circumferentially and constricted to the desired areolar diameter (usually 25–30 mm) at the end of the procedure.

Table 3 Outcome parameters.

	Overall collective <i>n</i> = 346	Group 1 <i>n</i> = 48	Group 2 <i>n</i> = 66	Group 3 <i>n</i> = 170	Group 4 <i>n</i> = 62
Complications	41 (11.8%)	5	7	21	7
Minor	5 (1.4%)	—	—	2	3
Partial NAC necrosis	3 (0.9%)	—	—	2	1
Seroma	2 (0.6%)	—	—	—	2
Major	36 (10.4%)	5	7	19	5
Full NAC necrosis	4 (1.2%)	—	2	2	—
Hematoma with revision	32 (9.2%)	5	5	17	5
Secondary revisions	31 (9%)	2	6	19	4
Scar revisions	5 (1.4%)	—	1	4	—
Contour revisions	19 (5.5%)	—	2	13	4
NAC revisions	7 (2%)	2	3	2	—

Outcome parameters: "complications" and "secondary revisions" (NAC: nipple–areola complex).

Table 4 Outcome parameters.

	Overall collective	Group 1	Group 2	Group 3	Group 4
Patient satisfaction	<i>n</i> = 158	<i>n</i> = 22	<i>n</i> = 29	<i>n</i> = 81	<i>n</i> = 26
1 = very good	77 (48.7%)	12	14	39	12
2 = good	62 (39.3%)	8	11	32	11
3 = less satisfied	18 (11.4%)	2	4	9	3
4 = not satisfied	1 (0.6%)	0	0	1	—
NAC sensitivity	<i>n</i> = 264	<i>n</i> = 44	<i>n</i> = 60	<i>n</i> = 160	—
1 = very good	110 (41.7%)	22	32	56	—
2 = good	102 (38.6%)	16	18	68	—
3 = moderate	48 (18.2%)	6	8	34	—
4 = not sensitive	4 (1.5%)	0	2	2	—

Outcome parameters: "Patient satisfaction" and "NAC sensitivity" (NAC: nipple–areola complex).

In moderate to large breast cases (C–D Cup), mastoptosis grade II with moderate to poor skin elasticity (Group 3), an inferior pedicled mammaplasty with the incision placed in the IMF was performed (Figure 3).

The anatomic midline, the IMF, the extent of breast parenchyma at the upper pole and the ellipsoidal resection figure of the skin redundancy were marked using the pinch test at the upright standing patient preoperatively. An infiltration solution of 50 ml 0.5% Xylocaine and 1:250,000 diluted adrenaline in 200 ml Ringer's solution was injected subcutaneously to reduce intraoperative blood loss. The inferior pedicle was deepithelialized in a width of 30–40 mm, leaving a NAC diameter of approximately 25–30 mm. The pedicle thickness was prepared with approximately 15–20 mm. Medial and lateral to the pedicle, the breast tissue was excised down to the pectoralis fascia. After tension-free approximation of the wound margins, the new position of the NAC was marked in the upright sitting patient. The subcutaneous fat

underneath the marked NAC was excised with the overlying skin. The pedicle was luxated through the access and the NAC was fixed in its new position.

In cases with very large breasts (>D Cup), mastoptosis grade III and poor skin elasticity (Group 4), we adopted the free nipple graft technique (Figure 4). After harvesting the NAC as a full-thickness graft, the glandular breast tissue was ellipsoidally resected according to the pinch test as described in Group 3 before. The NAC (excised with a diameter of 25–30 mm) was grafted onto its new location on the chest wall. Regarding the ideal placement of the NAC, we prefer to position the NAC according to the patient's own landmarks. The NAC should be placed on the existing nipple line going straight upward from the native site of the nipple at the junction of the fourth to fifth rib approximately 2–3 cm above the inferior margin of the pectoralis major muscle as defined by Hage et al.² Intraoperatively, we checked the final NAC position at the upright sitting patient for symmetry.

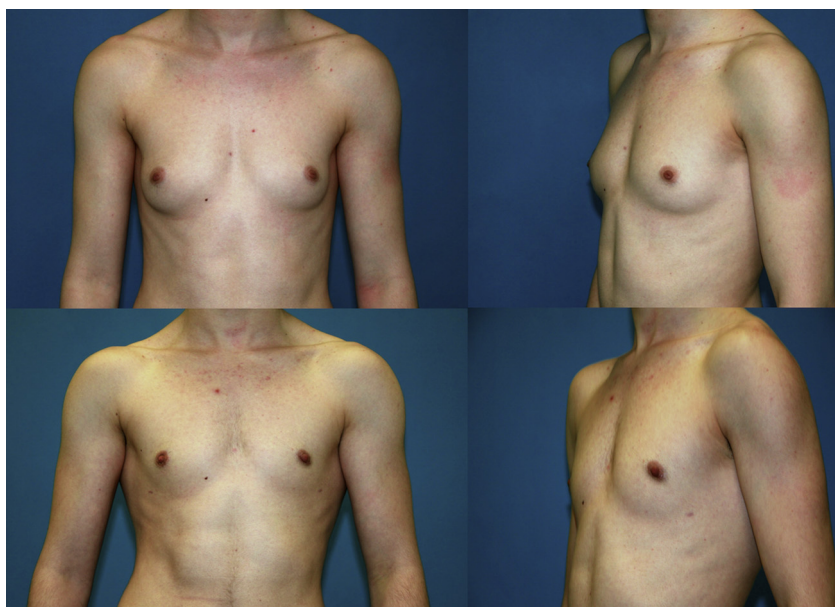


Figure 1 Group 1, patient example. 18-year-old patient preoperatively (above) and 1 year postoperatively (below) after water-jet-assisted liposuction (WAL) and semicircular subcutaneous mastectomy (SSCM). Resection weight of mastectomy: right side 72 g, left side 65 g; lipoaspirate volume: right side 20 ml, left side 20 ml.



Figure 2 Group 2, patient example. 23-year-old patient preoperatively (above) and 3 months postoperatively (below) after WAL, SSCM and concentric mastopexy. Resection weight of mastectomy: right side 110 g, left side 95 g; lipoaspirate volume: right side 20 ml, left side 20 ml.

In all cases, the resected breast glandular tissue was analyzed histopathologically. Drains were removed when drainage decreased below 30 ml in 24 h. Early mobilization and anticoagulation with low-dose heparin were prescribed directly after surgery. Wound dressing was completed by a tight-fitting compression garment applied immediately post-operatively in the operating room (OR). To avoid formation of a hematoma and a seroma and to generate optimal skin shrinkage, all patients were advised to wear compression

garments for at least 6 weeks day and night. Follow-up in the outpatient clinic was 14 days, 3 months and 12 months post-operatively. To evaluate our results qualitatively, we recorded the complication and secondary revision rate (Table 3). Moreover, a patient satisfaction survey concerning the aesthetic result and a subjective assessment of nipple sensitivity were performed (Table 4). Patient satisfaction could be rated as "very good" (1), "good" (2), "less satisfied" (3) and "not satisfied" (4). Nipple sensitivity was evaluated per breast

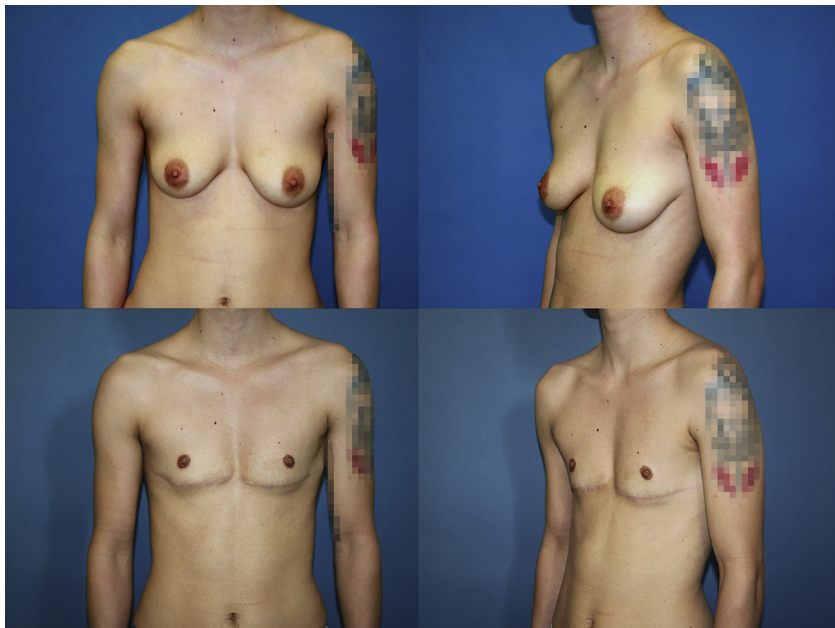


Figure 3 Group 3, patient example. 25-year old patient preoperatively (above) and 3 months postoperatively (below) after inferior pedicled mammaplasty. Resection weight of mastectomy: right side 186 g, left side 228 g.



Figure 4 Group 4, patient example. 39-year-old patient preoperatively (above) and 1 year postoperatively (below) after mastectomy and free nipple–areola complex (NAC) graft. Resection weight of mastectomy: right side 780 g, left side 675 g.

side as “very good” (1), “good” (2), “moderate” (3) and “not sensitive” (4).

Results

From January 2008 to December 2013, we performed 346 SCMs in 173 FTMTS patients (Table 2). The mean age in the overall collective was 28.6 years (range: 16–54 years), the mean distance between the sternal notch and NAC was 20.76 cm (range: 15–36 cm) and the mean BMI was 23.93 kg/m² (range: 17.1–39.5 kg/m²). The following mastectomy techniques were performed: 48 breasts (Group 1, 13.9%) underwent a semicircular incision in combination with water-jet-assisted liposuction, 66 breasts (Group 2, 19.1%) an additional circumferential mastopexy, 170 breasts (Group 3, 49.1%) an inferior pedicled mammaplasty and 62 breasts (Group 4, 17.9%) a mastectomy with free nipple grafting. The mean operation time lasted 103.6 min (range: 37–198 min). The average weight of the resected tissue was 354.1 g (range: 35–1700 g) on the right side and 352.1 g (range: 31–1400 g) on the left side. The mean length of hospital stay was 4.9 days (range: 2–9 days).

Complications were divided into minor, which could be managed conservatively (five SCMs, 1.4%) and major complications, where surgical revision was necessary (36 SCMs, 10.4%, Table 3). Minor complications included seroma (two SCMs, 0.6%) and partial NAC necrosis (three SCMs, 0.9%).

The most frequent major complication was hematoma requiring evacuation in 32 SCMs (9.2%); a full NAC necrosis occurred in four SCMs (1.2%). Reoperation for hematoma was most frequently found in Group 1 (five SCMs, 10.4%).

Secondary surgical corrections for aesthetic improvement were necessary in 31 SCMs (9%). These were grouped as scar revisions in five SCMs (1.4%) and contour corrections

(including liposuction, skin reduction and dog-ear corrections) in 19 SCMs (5.5%). NAC revisions (including nipple reduction, areola reshaping and nipple reconstruction) were necessary in seven SCMs (2%). The highest incidence of secondary corrections was found in Group 3 with 13 contour revisions of 170 mastectomies. Tertiary corrections were not necessary.

Of the total number of patients, 158 (91.3%) could be interviewed during the follow-up appointments and by telephone survey.

The patient survey revealed a high satisfaction rate with the aesthetic result (Table 4). Seventy-seven patients (48.7%) rated the results as “very good” (1), 62 patients (39.3%) rated the results as “good” (2), 18 patients (11.4%) were “less satisfied” (3) and one patient (0.6%) was “not satisfied” (4). Nipple sensitivity was rated subjectively in 110 NACs (41.7%) as “very good” (1), in 102 NACs (38.6%) as “good” (2), in 48 NACs (18.2%) as “moderate” (3) and in four NACs (1.5%) as “not sensitive” (4) (all total NAC necrosis). Group 4 was excluded in the sensitivity analysis due to free NAC grafting. No malignant or pathological findings were seen in the histopathological analysis. Patient satisfaction was high in all groups (88%).

Discussion

SCM is usually the first surgical procedure for FTMTS patients.

The main goal is to create an aesthetically pleasing male chest contour. The procedure is similar to mastectomy in gynecomastia but usually more difficult due to the considerably higher breast volume, greater degree of ptosis and skin elasticity. Moreover, the initial conditions are often negatively influenced by the common practice of breast binding.⁶

Patients should be classified according to the breast volume, grade of breast ptosis and skin elasticity before surgery. Breast ptosis was classified by Regnault⁵ as normal or pseudoptosis (grade 0, NAC above the IMF), mild (grade I, NAC at the level of the IMF), moderate (grade II, NAC below the IMF but above the breast contour) or severe (grade III, NAC below the IMF and below the breast contour).

Several techniques have been described in the literature depending on preoperative breast anatomy.^{1,2}

Traditional excision of the gland can be performed by different incisions: a semicircular incision at the inferior areolar margin, a transverse or hemitransverse areolar incision or an inframammary incision. Remaining skin excess and nipple retraction can occur in any technique chosen.

The semicircular technique (Figure 1) is essentially the same procedure described by Webster in 1946 for patients with low grades of gynecomastia.⁷ Hage and Bloem³ reported on chest-wall contouring for 70 FTMTS with SCM using the transareolar approach for those with minimal to moderate skin redundancy. The most important advantage of this technique is the small infraareolar scar. When combined with liposuction, it can improve postoperative skin shrinkage, allows an easier dissection between the skin envelope and glandular tissue and can flatten little skin contour irregularities, if necessary. In patients with very small breasts (A Cup), mastoptosis grade 0 and good skin quality and elasticity, the semicircular approach should be favored to prevent extra-areolar scarring, if possible. Due to good skin elasticity, the results can improve post-operatively over a period up to 1 year (at least 6 months) until skin shrinkage is completed. Therefore, secondary corrections should not be planned before that period of time has passed. In comparison to other techniques, the small surgical access is more challenging in excising the breast tissue and providing good hemostasis.

The concentric circular technique (Figure 2) was first described in 1979 by Davidson⁸ for patients with gynecomastia and later adopted by Benelli et al. in 1990 for mammoplasties in women.⁹ In 2000, Colic et al. published a study of 12 FTMTS, who underwent solely a circumareolar mastectomy and showed a high patient satisfaction due to the periareolar scar only.¹⁰ The advantage of this technique is the possibility of removing skin excess as well as the ability to reposition the NAC.

In patients with small breasts (A–B Cup), mastoptosis grade 0–I and moderate to poor skin elasticity, shrinking of the skin is unlikely and a concentric mastopexy as published by Davidson and Benelli^{8,9} is required.

However, for moderate to large breasts (C–D Cup) and mastoptosis grade II, longer incisions and scars are inevitable. With an inferior pedicled NAC, a preservation of NAC sensitivity is possible. In our article, we used this method according to the technique described by Kornstein et al. in 1992¹¹ (Figure 3). This technique provides to maintain the neurovascular integrity and form of the NAC. There are no breast mound scars, only a periareolar and inframammary scar.

The free nipple graft technique has been published particularly for patients with very large (>D Cup) and very ptotic breasts with poor skin elasticity (mastoptosis grade III)^{12–14} (Figure 4). The advantages of this technique are

excellent exposure and rapid mastectomy, areola and nipple resizing and repositioning as well as flattened male chest contouring because of the missing inferior NAC pedicle, which can potentially generate a higher breast projection in the lower breast pole.

So far, only a few algorithmic surgical approaches have been published. In the 1990s, Hage and Bloem introduced the “Amsterdam experience” with three main techniques³: in cases with minimal skin redundancy, the transareolar mastectomy was combined with concentric periareolar deepithelialization. Cases with greater breast volume or grade of ptosis were addressed with horizontal extensions adjacent to the NAC medially and laterally and the largest breasts underwent fusiform excision with a free NAC graft.

In 2008 and 2011, Monstrey et al. proposed five surgical options for mastectomy depending on breast volume, skin envelope, ptosis grade and skin elasticity as key factors^{4,15} in ascending order of: semicircular, transareolar, concentric circular, extended concentric approach and amputation with free nipple graft.

Based on our experience with 346 SCMs we performed in 173 FTMTS patients in 6 years, we present our results and algorithm to facilitate choosing the appropriate surgical technique (Table 1).

For very small breasts (A Cup), mastoptosis grade 0 by Regnault with good skin elasticity (Group 1), a semicircular technique is suitable (Figure 1). In cases with small breasts (A to B Cup), mastoptosis grade 0–I and presence of moderate to poor skin elasticity (Group 2), a concentric circumareolar approach is required (Figure 2).

Cases with moderate to large breasts (C to D Cup), mastoptosis grade II and moderate to poor skin quality (Group 3) require an inferior pedicled mammoplasty (Figure 3).

Cases with very large breasts (>D Cup), mastoptosis grade III and poor skin elasticity (Group 4) require a mastectomy with free nipple grafting (Figure 4). In comparison to the above mentioned algorithms by Hage and Monstrey et al.,^{3,4} we prefer a semicircular or circumareolar incision for small breasts with possible preservation of the neurovascular integrity and form of the NAC instead of potentially stigmatizing transareolar scars.

Postoperative complications can include hematoma, nipple necrosis (partial or full), wound infection, seroma, remaining skin excess, asymmetry, contour deformities, hypertrophic or keloid scars. In this series with 346 mastectomies, our overall complication rate was 11.8% (Table 3), similar to or even lower than the reported rate in the literature.^{16–19} Reoperation because of hematoma was performed in 9.2%. Both the semicircular and concentric circumareolar techniques are challenging in excising the breast tissue and providing good hemostasis due to a small access. The access in Group 1 is smaller due to no additional circumareolar deepithelialization. This could be a liable reason why reoperation for hematoma was most frequently found in these groups with prevalence in Group 1. The frequency of complications was very similar in all groups.

Secondary revisions in 31 mastectomies (9%) were comparable to the published data in the literature and mainly required in Group 3 due to the larger incisions, the

elaborated surgical method (preparation of the inferior pedicled NAC) and potential bulging of the pedicle post-operatively with necessity for contour revision by liposuction.

The patient survey revealed a high satisfaction level with the aesthetic result in all groups (Table 4). Of the patients, 88% rated the aesthetic results as "very good" or "good." Nipple sensitivity was rated as "very good" or "good" in 80.3% of the breasts.

Conclusion

To date, due to numerous pertinent FTMTS websites and discussion boards, FTMTS are a well-informed patient population and therefore increasingly more demanding for aesthetic outcomes. If possible, the most scar-saving procedure should be preferred. With ascending degrees of ptosis, a larger skin envelope and lesser elastic skin, an extended-incision technique is required.

The presented surgical algorithm facilitates the selection of the appropriate mastectomy technique, rarely leads to complications and secondary aesthetic corrections and shows a high patient satisfaction with the aesthetic result and, if possible, a preservation of nipple sensitivity.

Ethical approval

Not required.

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Conflict of interest

There is no conflict of interest.

Financial disclosure

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